REMARKS

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Claims 1, 18, 19 and 20 have been amended to clarify that the optical system recited in these claims includes a revolver for switching the objective lenses, as supported by the disclosure in the specification at, for example, page 11, lines 22-26 and page 17, lines 6-11.

It is noted that these claims already recited the feature of the present invention whereby the objective lenses are adapted to be selectively placed on the optical path, and it is respectfully submitted that no new matter has been added and that no new issues have been raised which require further consideration on the merits and/or a new search.

Accordingly, it is respectfully requested that the amendments to claims 1, 18, 19 and 20 be approved and entered under 37 CFR 1.116.

THE PRIOR ART REJECTION

Claims 1-3, 5-7, and 10-21 were (again) all rejected under 35 USC 103 as being obvious in view of various combinations of USP 5,862,287 ("Stock et al"), the G.J. Brakenhoff et al publication cited by the Applicant ("Brakenhoff et al"), USP 5,034,613

("Denk et al") and/or USP 6,169,289 ("White et al). These rejections, however, are (again) respectfully traversed.

According to the structure of the claimed present invention, an optical system of a mulitphoton excitation scanning laser microscope is provided which includes both a pre-chirp compensator which provides a certain (constant value) amount of pre-chirp compensation and a correcting mechanism which corrects the optical path length when the objective lens to be used is switched. It is respectfully pointed out that this structure avoids adjustment of the pre-chirp amount, which would otherwise be required if an objective lens having a different optical path length were to be switched. And it is respectfully submitted that none of the cited references discloses, teaches or suggests both a pre-chirp compensator (whose compensation amount is kept at a constant value) and a correcting mechanism for correcting the optical path length when the objective lens to be used is switched, as according to the claimed present invention.

It is respectfully pointed out, moreover, that the object of the claimed present invention is not to restore the pulse-width to its original value by performing pre-chirp compensation. Indeed, the "optical correcting element" of the correcting mechanism for correcting the optical path length according to the present invention functions as a compressor for compressing the optical pulse in cooperation with the optical fiber. However, if the function of the optical correcting element functioning as the

compressor is considered, the optical correcting element can be referred to as compensation amount adjusting means for variably adjusting the compression amount of the optical pulse in accordance with the type of the objective lens used.

As recognized by the Examiner, Brakenhoff et al discloses a variable-height translation stage ("station") on which a sample is mounted, and pre-chirp compensation. To be more specific, according to Brakenhoff et al, a "TPA (two-photon absorption) auto-correlation technique" permits interactive control of the pulse width at the focal point of a high-NA lens. This is demonstrated in Fig. 7(a) of Brakenhoff et al. By proper adjustment of the prisms in position, it is possible to restore the broadened optical pulse almost completely to its initial value, even if the kind of objective lens used is changed. And as shown in Figs. 7(a) and (b) of Brakenhoff et al, whichever objective lens ("student" or "Nikon") is used, the minimum pulse width is obtained by changing the positions of the prisms in accordance with the kind of objective lens used ("student" or "Nikon").

It is respectfully pointed out, however, that the disclosure of "interactive control of the pulse width at the focal point of a high-NA lens" in Brakenhoff et al merely means that the pulse width can be controlled by adjustment of the prisms in position (i.e., adjusting the chirp amount of the pre-chirp compensator).

And it is respectfully submitted that Brakenhoff et al does not disclose, teach or suggest driving the correcting mechanism for correcting the optical path length in accordance with the type of objective lens used, without varying the chirp amount of the pre-chirp compensator. In other words, it is respectfully submitted that this reference does not disclose, teach or suggest a correcting mechanism for keeping the optical path length constant, regardless of the type of objective lens used, as according to the claimed present invention.

In fact, Brakenhoff does not even recognize the problem whereby the optical axis is displaced when the prisms of the pre-chirp compensator are moved.

With respect to Stock, it is noted that this reference discloses at column 6, line 60 to column 7 line 15 that an optical fiber functions as a compressor for giving a positive chirp, and that the length of the optical fiber is designed such that the fiber gives a predetermined amount of positive chirp.

In addition, Stock discloses at column 7, line 60 to column 8, line 3 that:

> "The present invention can provide dispersion compensation for positive or negative dispersion effects. This allows for flexible optimization which can be calibrated to the optical path of the system so that a system user may provide the proper pre-compensation for an adjustable system, e.g., the microscope objectives in a turret in a two-photon laser scanning microscope. Such methods bring increased flexibility, robustness, and reliability to system design, as well as improved signal-to-noise ratio and resolution in the overall system."

Thus, Stock discloses that positive or negative dispersion effects can be flexibly controlled in accordance with the optical path length of the system. However, actually, adjustment of the positive chirp amount corresponds to adjustment of the length of the optical fiber, and adjustment of the negative chirp amount corresponds to adjustment of the chirp amount in the pre-chirp compensator. (And it is noted that the negative chirp amount is explained in column 6, lines 20-59.)

Accordingly, it is respectfully submitted that even if the technique of Stock were applied to the present invention, it would still be impossible to selectively use optical fibers of different lengths in accordance with switching of the objective lens to be used. In this connection, it is noted that when the chirp amount of the pre-chirp compensator is changed, the optical axis is displaced.

Still further, it is noted that on page 4 of the Final Office Action the Examiner asserts that Stock teaches an interlocking mechanism for causing the correcting mechanism to be interlocked with the objective lens. Indeed, column 3 of Stock discloses a two-photon laser microscope, but it is respectfully submitted that this reference does not explain the structure of an interlocking mechanism for causing the correcting mechanism to be interlocked with the objective lenses.

With respect to item 3 on page 4 of the Final Office Action, moreover, it is noted that page 253, column 2 of Brakenhoff et al

discloses a fluorescence microscope using TPA (two-photon absorption), and also that the pulse is distorted in focusing of the ultrashort pulse which is required for OCT (optical coherence tomography) and TPA. Thus, it is therefore necessary to measure the actual pulse width at the point of interest; and this reference explains the measurement of the pulse width which uses the "two-photon absorption autocorralation" and the restoration of the pulse width due to pre-chirp compensation. Nevertheless, it is respectfully submitted that Brakenhoff et al also fails to disclose, teach or suggest an interlocking mechanism for causing the correcting mechanism to be interlocked with the objective lenses.

In view of the foregoing, it is respectfully submitted that the cited references fail to disclose, teach or suggest the structural features and advantageous of the claimed present invention, and that the claimed present invention patentably distinguishes over the cited references, taken singly or in combination, under 35 USC 103.

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Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,

Douglas Holtz
Reg. No. 33,902

Frishauf, Holtz, Goodman & Chick, P.C.
767 Third Avenue - 25th Floor
New York, New York 10017-2023
Tel. No. (212) 319-4900
Fax No. (212) 319-5101

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 1, 18, 19 and 20 have been amended as follows:

1. (Third Amended) A multiphoton excitation scanning laser microscope, comprising:

(a) a station for placing a sample to be observed;

(b) a laser beam source for emitting a pulse laser beam for exciting said sample to cause the sample to emit a fluorescent light by multiphoton excitation phenomenon;

(c) a detector for detecting said fluorescent light; and

(d) an optical system for forming an optical path of said pulse laser beam for guiding said pulse laser beam from said laser beam source to said sample, said optical system including:

a pre-chirp compensator disposed on said optical path such that the pulse laser beam passes therethrough, and preset to provide said pulse laser beam with a certain amount of pre-chirp compensation, said pre-chirp compensator comprising optical elements which cause components of the pulse laser beam to be emitted in order of wavelength such that shorter wavelengths are emitted earlier than longer wavelengths,

a plurality of objective lenses adapted to be selectively placed on said optical path for collecting the pulse laser beam on the sample,

<u>a revolver for switching the objective lenses,</u> and

a correcting mechanism for correcting an optical path length of said optical path so as to be constant no matter which

of said objective lenses is selectively placed on said optical path,

wherein said correcting mechanism comprises at least one optical correcting element adapted to be selectively placed on said optical path in accordance with which of said objective lenses is selectively placed on said optical path, and

wherein said certain amount of pre-chirp compensation provided by said pre-chirp compensator is set to prevent a pulse width of said pulse laser beam from widening due to a wavelength range of a pulse of said pulse laser beam when said pulse laser beam passes through said optical path whose optical path length is kept constant.

18. (Second Amended) A multiphoton excitation scanning laser microscope, comprising:

(a) a station for placing a sample to be observed;

(b) a laser beam source for emitting a pulse laser beam for exciting said sample to cause the sample to emit a fluorescent light by multiphoton excitation phenomenon;

(c) a detector for detecting said fluorescent light; and

(d) an optical system for forming an optical path of said pulse laser beam for guiding said pulse laser beam from said laser beam source to said sample, said optical system including:

a pre-chirp compensator disposed on said optical path such that the pulse laser beam passes therethrough, and preset to

provide said pulse laser beam with a certain amount of pre-chirp compensation, said pre-chirp compensator comprising optical elements which cause components of the pulse laser beam to be emitted in order of wavelength such that shorter wavelengths are emitted earlier than longer wavelengths,

a plurality of objective lenses adapted to be selectively placed on said optical path for collecting the pulse laser beam on the sample,

<u>a revolver for switching the objective lenses,</u> and

a correcting mechanism for causing an optical path length of said optical path to be constant no matter which of said objective lenses is selectively placed on said optical path,

wherein said correcting mechanism comprises an optical correcting element whose optical path length is adjustable by applying different voltages in accordance with which of said objective lenses is selectively placed on said optical path, and

wherein said certain amount of pre-chirp compensation provided by said pre-chirp compensator is set to prevent a pulse width of said pulse laser beam from widening due to a wavelength range of a pulse of said pulse laser beam when said pulse laser beam passes through said optical path whose optical path length is kept constant.

19. (Second Amended) A multiphoton excitation scanning laser microscope, comprising:

(a) a station for placing a sample to be observed;

(b) a laser beam source for emitting a pulse laser beam for exciting said sample to cause the sample to emit a fluorescent light by multiphoton excitation phenomenon;

(c) a detector for detecting said fluorescent light; and

(d) an optical system for forming an optical path of said pulse laser beam for guiding said pulse laser beam from said laser beam source to said sample, said optical system including:

a pre-chirp compensator disposed on said optical path such that the pulse laser beam passes therethrough, and preset to provide said pulse laser beam with a certain amount of pre-chirp compensation, said pre-chirp compensator comprising optical elements which cause components of the pulse laser beam to be emitted in order of wavelength such that shorter wavelengths are emitted earlier than longer wavelengths,

a plurality of objective lenses adapted to be selectively placed on said optical path for collecting the pulse laser beam on the sample,

<u>a revolver for switching the objective lenses,</u> and

a correcting mechanism for causing an optical path length of said optical path to be constant no matter which of said objective lenses is selectively placed on said optical path,

wherein said correcting mechanism comprises an optical correcting element whose optical path length is adjustable by

applying different pressures in accordance with which of said objective lenses is selectively placed on said optical path, and

wherein said certain amount of pre-chirp compensation provided by said pre-chirp compensator is set to prevent a pulse width of said pulse laser beam from widening due to a wavelength range of a pulse of said pulse laser beam when said pulse laser beam passes through said optical path whose optical path length is kept constant.

20. (Second Amended) A multiphoton excitation scanning laser microscope, comprising:

(a) a station for placing a sample to be observed;

(b) a laser beam source for emitting a pulse laser beam for exciting said sample to cause the sample to emit a fluorescent light by multiphoton excitation phenomenon;

(c) a detector for detecting said fluorescent light; and

(d) an optical system for forming an optical path of said pulse laser beam for guiding said pulse laser beam from said laser beam source to said sample, said optical system including:

a pre-chirp compensator disposed on said optical path such that the pulse laser beam passes therethrough, and preset to provide said pulse laser beam with a certain amount of pre-chirp compensation, said pre-chirp compensator comprising optical elements which cause components of the pulse laser beam to be emitted in order of wavelength such that shorter wavelengths are emitted earlier than longer wavelengths,

a plurality of objective lenses adapted to be selectively placed on said optical path for collecting the pulse laser beam on the sample,

a revolver for switching the objective lenses, and

a correcting mechanism for causing an optical path length of said optical path to be constant no matter which of said objective lenses is selectively placed on said optical path, and

wherein said certain amount of pre-chirp compensation provided by said pre-chirp compensator is set to prevent a pulse width of said pulse laser beam from widening due to a wavelength range of a pulse of said pulse laser beam when said pulse laser beam passes through said optical path whose optical path length is kept constant.